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Age-dependent gains after balance training in ataxic neuropathies

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Keywords: Balance; Proprioception; Aging; Neuropathy; Ataxia

Objectives.– A rehabilitation program including foot sensory stimulation, balance and gait training with limited vision was performed by 22 patients with ataxic neuropathy.

Methods.– Patients were divided in two subgroups corresponding to a middle-age group (medium age = 55 y) and an older adults group (m = 75 y).

Results.– At the end of this program, balance control assessed using the Berg Balance Test, timed Up and Go and Functional Reach Test improved similarly in both groups ($P < 0.001$). By contrast, only middle-age adults were able to increase the contribution of sensory afferent with a significant reduction of Romberg sign ($Khi^2 = 6.6$, $P = 0.01$).

Discussion.– These results show that ataxic patients can improve their balance with better results in dynamic than static conditions whatever their age. Nevertheless, an age effect can be pointed out as older adults unless younger do not succeed to improve sensory integration during static balance. This study gives news insights for the interest of proprioceptive rehabilitation in ataxic patients as an insufficient contribution of neuronal plasticity may be suggested to explain a decrease in static balance ability when improving dynamic balance remains a realistic goal even in older patients.

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Postural control and vibrations: A plan-dependent effect?

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Keywords: Sensory-motor integration; Proprioception; Ageing; Hemispheric treatment

Objective.– To compare the effect of the age or of a hemispheric cerebral lesion on the utilization of proprioceptive information during a basic postural task.

Methods.– In standing position, we applied vibrations (during 20 s at 80 Hz, to imitate a muscular stretch) on ankle (Achilles or Peroneus) tendons of 15 healthy senior adults and 19 stroke patients: 11 with a left/9 with a right cerebral lesion. Standard posturographic parameters were recorded.

Results.– Peroneus and Achilles vibrations lead to a backward shift of the Center of Pressure. The postural reaction for senior adults permits to dissociate the right cerebral hemisphere as dominant for controlling the situation. Patients with a right hemispheric lesion are the most instable with vibrations and are the most sensitive to medio-lateral vibrations. After vibrations, they show a particular difficulty to stabilize medio-lateral oscillations.

Discussion.– The organization of the induced displacements by vibrations stays similar between the 3 populations. The differential effect of the vibrated-muscles, each one controlling a specific direction of body oscillations, shows that the cortical treatment for the postural organization is plan-dependent. The medio-lateral plan, the most pertinent to stabilize, seems depending on the right cerebral integration without link with ageing.

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Proprioception and cortical hemispheric treatment

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Keywords: Sensory-motor integration; Postural control; Hemiparesis; Paretic limb; Instability

Objective.– To determine the proprioceptive sensitivity of the cerebral hemispheres and their plays in the sensory-motor integration process required for the postural control.

Methods.– At this day, we applied vibrations on Achilles or Peroneus tendons (20 s, 80 Hz) on the paretic or on the "non-affected" lower limb (LL) of 19 stroke patients (8 with a right [RHL]/11 with a left [LHL] hemispheric lesion), in standing position. Standard posturographic parameters were recorded.

Results.– RHL patients are more instable than LHL patients, what is increased by vibrations.

Vibrations applied on the paretic LL for LHL patients lead to no displacement of the center of pressure. On the contrary, the postural reaction is significant for RHL patients. Both groups of patients react in a similar way to vibrations on their "non-affected" LL.

Discussion.– The postural instability is still a dominant aspect of the right hemispheric lesion (left hemiparesis). Our results suggest that the proprioceptive integration by the right cortical hemisphere is more sensitive and reactive for standing postural control. Organizational strategies of postural reactions are depending on the stimulated hemisphere, in the adaptive reactivity related to the perturbation as well as in post-effects at the suspension of vibrations.

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Ankle deformities, rather than spasticity, impair activities and participation of adult stroke patients

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Keywords: Stroke; Gait; ICF; Spasticity; Instrumental indices

Background.– In the gait of hemiparetic patients, body functions and structures (F&S) impairments of the affected side may not directly cause activities and participation (A&P) limitations, as a result of contralateral side compensatory contributions. Thus, we investigated the relationships between scores of F&S, walking ability (WA) and A&P.

Methods.– We retrospectively analyzed 26 stroke patients. F&S evaluations: passive and active ankle dorsiflexion (pDF, aDF), triceps surae (TS) spasticity. A&P assessments: Functional Ambulation Categories (FAC), Rivermead Mobility Index (RMI) and Walking Handicap Scale (WHS). WA assessments: walking speed, dynamic loading and propulsion ability (DLA and DPA) calculated as in [1]. The relationships were assessed by Spearman's correlation coefficient.

Results.– TS spasticity did not affect any of the A&P and WA measurements. aDFs were correlated with all A&P measurements and pDFs were correlated with FAC and WHS. The strongest correlations were found between the DLA and DPA indices and all A&P scores. DLA was correlated with aDF and DPA with pDF.

Conclusions.– Adult stroke patients' A&P depends more upon ankle deformities than spasticity. S&F impairments altering foot prepositioning at contact and tibia forward rotation during stance should be considered from the early rehabilitation stage.

Reference
[1] Gait Posture 2009;30:127–31.

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Neck muscle vibration and stroke patients

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Keywords: Stroke; Balance; Neck muscle vibration

Posture disorders determine the functional outcome of stroke patients.
Methods.– The short-term effect of neck muscle vibration (NMV) was explored in 30 patients (14 right hemisphere stroke and 16 left hemisphere stroke; average 61.6 years, average 3.1 months post-stroke). The lateral shift has been measured with a strength platform before and after ten minutes of NMV. Patient has visual susceptibility if he perceives the illusion of a light spot lateral movement.
Results.– The lateral shift with eyes closed of 70% of patients is improved (average 9 mm), with eyes open 63% is improved (average 5.6 mm). Right and left hemisphere stroke are not significantly different. The decreased sensitivity and visual vibration susceptibility seem to be a predictive factor of efficiency on postural bias. Probably, reacting patients have a poor spatial representation.
Discussion.– This rehabilitation of posture with this sensorial stimulation would be focused on susceptible patients or reacting patients (for example with decreased sensibility). This therapeutic contribution is currently exploring in another study.
Further reading
Biguer. Neck muscle vibration modifies representation of visual motion and direction man. Brain 1988;111:1405–24.
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Effect of sensory stimulations in improving balance after stroke

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Keywords: Stroke; Balance; Sensory stimulation; Galvanic stimulation; Optokinetic stimulation; Force platform

Background.– Sensory stimulations could be effective to reduce the postural bias of hemiplegic patients but the mechanism underlying such effect is not yet fully established.
Objective.– To compare the effect of two sensory stimulations in three groups, control, left lesioned and right lesioned hemiplegics (LLH,RLH).
Methods.– Twenty-nine control subjects (mean age), 18 LLH (mean age 51.6 y, mean delay since stroke 2.8 mo), 17 RLH (mean age 56.8 y, mean delay since stroke 3.2 mo) were tested using a force platform. The standing subjects were successively stimulated by rotating optokinetic and galvanic stimulations.
Results.– The effect of the two stimulations were significantly different between the RLH and the other two groups (respectively $P = 0.02$ and $P = 0.03$) for the displacement toward the left direction (optokinetic mean displacement respectively 25.8 (23.8) for RLH, 10.4 (16.0) for LLH, 9.7 (15.2) for control and galvanic mean displacement, respectively 14.2 (17.1) for RLH, 4.2 (8.8) for LLH, 7.3 (9.9) for control). The sensory stimulations were more effective to reduce the bias in RLH but the effect was not different between the LLH and the controls.
Discussion.– These results suggest that areas of the right hemisphere are partly involved in the exaggerate postural bias of RLH whenever the bias observed in LLH could be exclusively the consequences of mechanical mechanisms.

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Polymodal areas in the right brain support the human sense of upright

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Keywords: Sense of upright; Vestibular cortex; Stroke; Voxel Lesion Behavior Mapping (VLBM) statistical approach

Goals.– The sense of upright is often altered after stroke. We analysed its neural bases in the personal (Postural vertical, PV) and the extrapersonal (Visual vertical, VV) spaces, in relation to the vestibular cortex.
Patients and methods.– VV and PV were assessed in 66 first hemisphere stroke patients (58 ± 15 years, 25 F-41 M, 41 Right-25 Left), analysed by voxel lesion behaviour mapping (VLBM) statistical approach and then compared to a meta-analytic cartography of human vestibular cortex [1].
Results.– VV tilts were contralesional in 45% and ipsilesional in 9%. PV tilts (42%) were always contralesional. Tilts in vertical estimates were more pronounced after right than left lesions for VV (-4.2° vs -1.7°; $t(64) = -2.11$; $P = 0.03$) and PV (-5° vs -0.7°; $t(64) = -4.67$; $P < 0.01$). In right lesions, polymodal areas of sense of verticality were the operculo-insular cortex and the posterolateral thalamus. Only 14% of this core for the sense of verticality overlapped the vestibular areas. In left lesions, the rarity of PV tilts (3 patients) made irrelevant any VLBM analysis.
Conclusion.– The operculo-insular cortex and posterolateral thalamus in the right hemisphere support the human sense of upright, which must be improved by rehabilitation after right hemisphere stroke. Surprisingly, the overlap with the vestibular cortex was weak.
Reference
[1] Lopez, et al. Neuroscience 2012.

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Influence of repeated effort induced by a 6-min Walk Test on postural response in older women

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Keywords: Aerobic exercice; Elderly; Stabilometric analysis; Dynamic methods

Aim.– The aim of this paper was to explore the effect of repeated efforts induced by a 6-minute walk test (6MWT) on the postural responses in 49 older sedentary and osteopenic women.
Methods.– We hypothesized a degradation of the postural responses associated with an increase of center of pressure (COP) fluctuations and a loss of the complexity of the COP time series. To that end, we used kinematic stabilometric parameters combined with recurrence quantification analysis (RQA) and central tendency measure (CTM) extracted from COP signals.